Conservation Voltage Reduction (CVR)

Conservation Voltage Reduction, or CVR, is a low-cost option available for distribution electric utilities to reduce energy consumption and peak demand for short periods of time without a noticeable impact in power quality or service interruption to their customers. Typically, CVR is accomplished by slightly reducing the distribution voltage at the substation, as controlled by the utility. For electric consumers, reducing the voltage by a fractional amount also creates a reduction in energy consumption, thereby reducing their energy costs without any effort or need on the customer’s part to understand or modify usage habits. This also has the effect of reducing distribution line losses for the utility while the CVR is in effect. While some distribution utilities have been implementing CVR to reduce their wholesale peak demand costs, this method is gaining acceptance for energy savings as well.

How does CVR work?

ANSI C84.1 standard defines nominal voltage ratings and tolerances for North American electric distribution. The standard under the optimal voltage Range A criteria sets a +/- 5 percent deviation as acceptable limits for service voltage on systems operating between 120 and 600 volts. This translates to an acceptable service voltage (on a 120 volt nominal basis) between 114 V on the lower end to 126 V on the higher side for customer loads. The goal of CVR is to reduce energy losses and consumption by operating toward the lower end of these voltage ranges but still maintain adequate voltage levels to all customers above the lower voltage threshold per ANSI C84.1. Utilities can opt to control bus voltage regulators at their distribution substations to affect the voltage reduction for short and specific periods during peak load conditions to achieve temporary peak demand reduction. CVR can also be applied during non-peak periods to reduce energy consumption. With remote control capabilities from a central SCADA system, this process can be automated and centrally managed by the utility operations group.

What’s New at PSE

Power System Engineering (PSE) is happy to announce several new additions to our staff:

- Andrew Kachmarsky, P.E. is a Senior Substation Engineer in our Madison, WI office.
- Dr. Lullit Getachew joined our Madison, WI office as a Senior Economist.
- Karla Ditsch-Moen is our Business Office Administrator based in our Madison, WI.
- Chris Graff is an Electrical Engineer based out of our Sioux Falls, SD office.

(continued on page 2)
We were recently asked by a client if there were a simple way, with low initial capital investment, to test whether demand response is right for them. They had recently deployed an AMI system and were interested in piloting a demand response program.

The simple answer is yes. In fact, PSE is currently assisting several utilities around the country in setting up pilots involving a program called Peak Time Rebate (PTR). PTR offers customers a rebate based on the kWh amount of electricity use they curtail during peak time/high-cost events. With a proper program design, this can be a “win-win” for both the participants and the utility. Participants benefit by receiving rebates with no risk of being financially harmed, and the utility can benefit by avoiding demand charges and lowering exposure to future power supply price shocks. If marketing and recruitment strategies are well-designed, high participation rates can be expected compared to other pricing and demand response programs. An advantage over other dynamic pricing options is that no change in the underlying rate design is necessary.

This program does necessitate calculation of the customer baseline load (CBL) using statistical techniques that adjust for the influence of weather and other impacts. This provides an accurate assessment of the curtailment in electricity use for each consumer and also eliminates the possibility for consumer gaming, which has been an issue for other PTR pilots around the country which used simpler (and less accurate) CBL calculation methods. A regression-based CBL calculation also is helpful when conducting an impact evaluation of the program and uncovering consumer characteristics that make them more likely to respond to the program.

If this program proves to be successful, it enables utilities to market one program (PTR) with all other demand response programs placed underneath the “PTR Umbrella.” Essentially, every other demand response program would further the partnership between the utility and participants by helping the utility avoid more power supply costs and the participants to increase their rebate amounts. For example, a direct load control program is offered for PTR participants, the participants would benefit from higher rebate amounts, and the utility may benefit by higher margins.

Overall, this program has relatively low start-up costs (assuming interval data is readily available), has no risk to participants, and low risk to the utility. Studies on similar programs across the country have shown that consumers do respond to a PTR and it enhances their view of their utility. If you are interested in exploring a PTR program further, PSE would be happy to assist you.
Getting More from your GIS — Telecommunications

The Smart Grid is enabled by telecommunications ranging from shorter distance mesh networks of electric meters, longer distance communications from distribution automation devices to collection points at electric substations or communications towers, and longer distance backhaul communications from electric substations and radio tower sites. Communications assets include electric meters with radios and antennas under the glass, microwave communications base stations, antennas, cables, communications towers, fiber optic networks, and third-party telecommunications networks. Management of these communications assets becomes ever more important as Smart Grid applications increase the number of communications devices and the requirement shifts from non-critical, periodic monitoring to real-time control. The use of GIS to combine electrical and communications networks and devices has many benefits, including asset management, spatial representation of communications networks, and communications network planning.

GIS can consolidate all of your communications network information that is likely residing in multiple spreadsheets, CAD drawings, databases, and RF planning tools, and spatially represent the communications network as one or more layers that may be overlaid onto your electric network. Options to add telecommunications range from purchasing add-on modules (such as the Physical Network Inventory add-on for GE Smallworld) to modifying your GIS data model to add the features (radios, antennas, towers, RF coax, switches, etc.) that are most important to your operation. After modifying your data model to include wired or wireless communications assets, connectivity can be added to provide tracing functionality similar to that of the electric network. This allows questions such as “what electric devices will lose communications if a repeater radio is lost to a lightning strike?” to be readily answered.

GIS may also be used for telecommunications network planning. While RF propagation tools include increasingly sophisticated topographical information, porting your electric network and service territory information is not an option or very time consuming. GIS can be used to determine the percentage of meters that can be communicated with via RF AMI technology, substations and towers that can “see” each other to determine if a microwave backhaul is feasible, the percentage of distribution automation feeder devices (switches, capacitor banks, voltage regulators, sensors, etc.) that will be communicated to based on import of a coverage diagram from RF propagation software, the percentage of service territory or roads that will be covered by a candidate private mobile radio network, and much more.

Contact PSE for help to get your GIS ready to help you manage both your electrical and communications networks.

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Ask PSE a Question

Do we need a distribution wheeling rate, and how do we establish one?

A distribution wheeling rate is appropriate when a customer uses the utility’s distribution system to transport power for wholesale delivery purposes. Examples would be a wind developer that is connecting to your distribution system to sell its output to another utility. A distribution wheeling rate is similar to the unbundling of distribution delivery service that was discussed extensively (and in cases implemented) during the mid and late 1990s as part of deregulation efforts in certain jurisdictions.

Simply stated, a distribution wheeling rate should reflect the utility’s cost of providing distribution service. Cost of service is defined as operating expenses plus margin requirements. Two acceptable approaches to accomplish this are the 1) system approach and 2) direct approach.

### System Approach
- Financial statements
- System load data.
- Broad application.
- Ignores project specifics.

### Direct Approach
- Specific plant records
- Specific load data.
- Limited application.
- Project specific.

The system approach is relatively straightforward and is based on system-wide financial and load data. A cost allocation procedure is used to determine the total pool of dollars applicable to the service, which is then divided by either system demand or energy to establish the rate. This rate can, in most cases, be offered system-wide to any customer requesting service.

The direct approach is much more detailed and complicated. The details on the specific facilities being used are analyzed, which form the basis for the rate. In many cases, it is simply not feasible to make this type of determination. Even if achieved, the rate is “unique” and likely cannot be applied in other situations.

If you have more detailed questions, please don’t hesitate to get in touch with us.
PSE provides a full range of engineering, economic, and planning services to utilities nationwide. Some of our services include:

- Communications (Fixed and Mobile)
- Technology Work Plans & Strategic Plans
- Transmission & Distribution Studies and Planning
- Transmission & Distribution Line Design
- Daily Operations & Engineering Support
- Rates and Cost of Service Studies
- Time of Use and Dynamic Pricing
- DG Rates and Contracts
- Energy Efficiency & Demand Response Evaluation
- Load Forecasting with & without Demand Side Management
- Substation Engineering & Design
- Consulting on AMI, SCADA, IVR, OMS, GIS, CIS, etc.

Please be sure to give the PSE team the opportunity to present our ideas on how we can work together. We are confident that our full range of services can meet your needs. Visit our website for a full list of services and additional contacts.